

United States Patent [19]

Flies

[11] Patent Number: **4,659,915**

[45] Date of Patent: **Apr. 21, 1987**

[54] **RECEPTACLE DESIGN FOR USE WITH ELECTRONIC KEY-LIKE DEVICE**

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[73] Assignee: **Datakey, Inc., Burnsville, Minn.**

[21] Appl. No.: **784,225**

[22] Filed: **Oct. 4, 1985**

Related U.S. Application Data

[62] Division of Ser. No. 471,424, Mar. 2, 1983, Pat. No. 4,620,088.

[51] Int. Cl.⁴ **G06K 7/06**

[52] U.S. Cl. **235/441; 200/42.02; 235/492; 235/382**

[58] Field of Search **235/492, 382, 441; 340/825.31; 200/42.02, 43.22**

[56] References Cited

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3,657,496 4/1972 Davidson 200/42.02

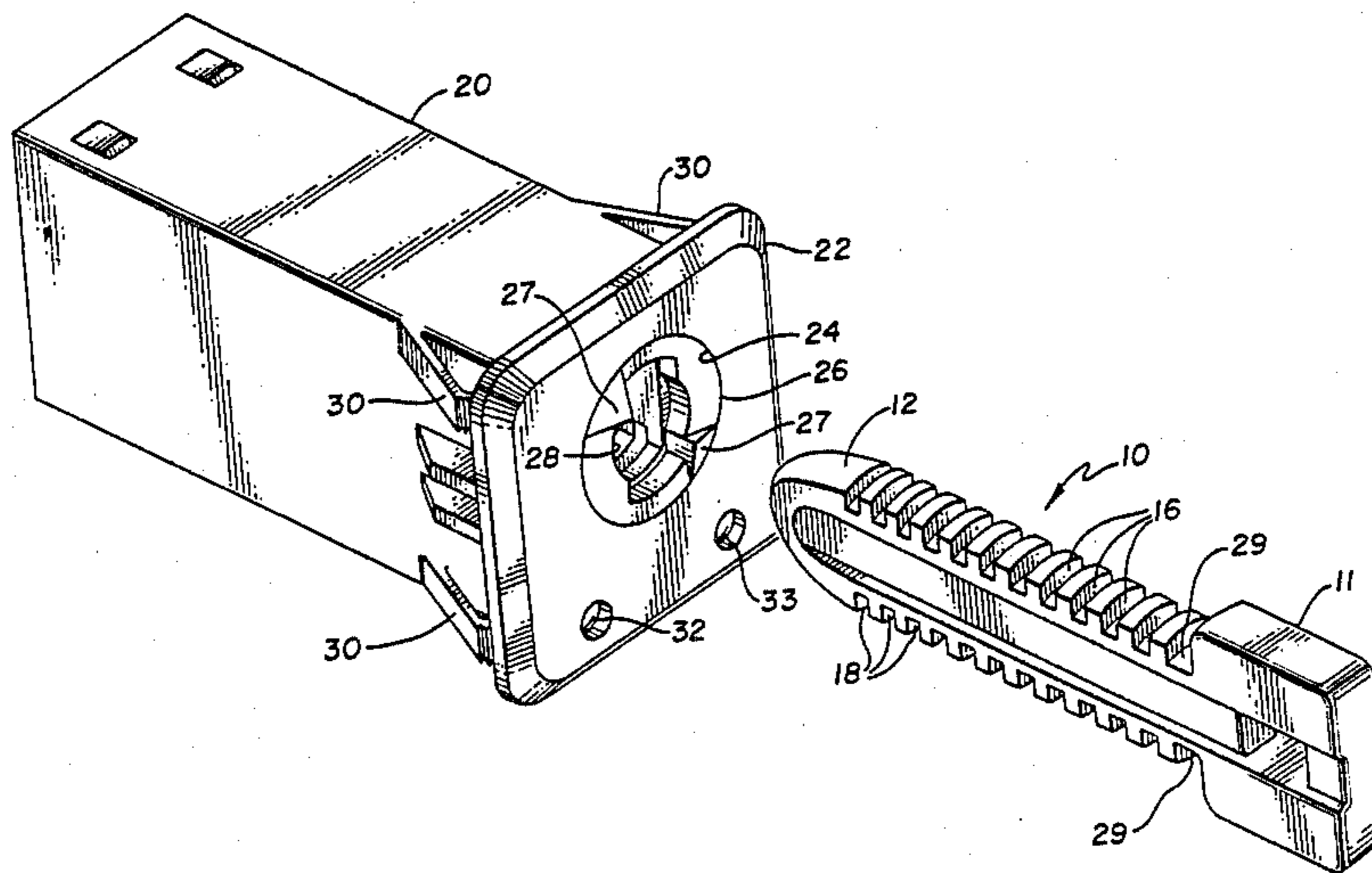
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Primary Examiner—David L. Trafton
Attorney, Agent, or Firm—Vidas & Arrett

[57] ABSTRACT

Receptacle for a key-like device containing an embedded electronic circuit component with leads extending to the surface of the key to form contact areas thereon. The receptacle defines a keyway in which a plurality of contact pins are positioned and spaced to correspond to the spacing of the electrical contact areas on the key. The receptacle preferably includes a head protect sleeve which functions as a guard means for the contact pins therein. The receptacle is designed to be connected with a printed circuit board by means of staked contact pins which may be arranged in a variety of predetermined patterns on the circuit board facilitating electrical connection of the receptacle contact pins to a variety of standardized electrical connectors.

3 Claims, 15 Drawing Figures



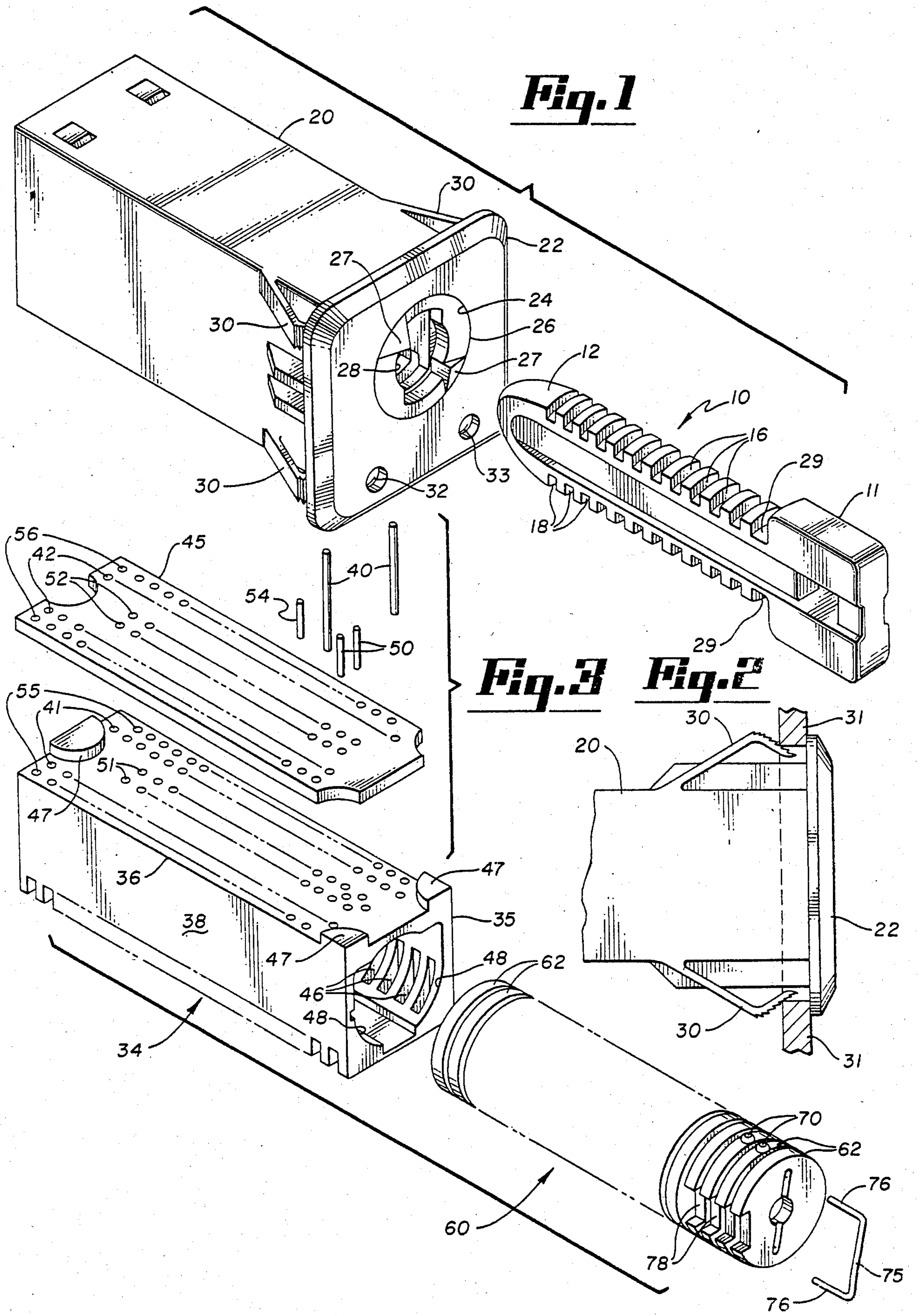


Fig. 4

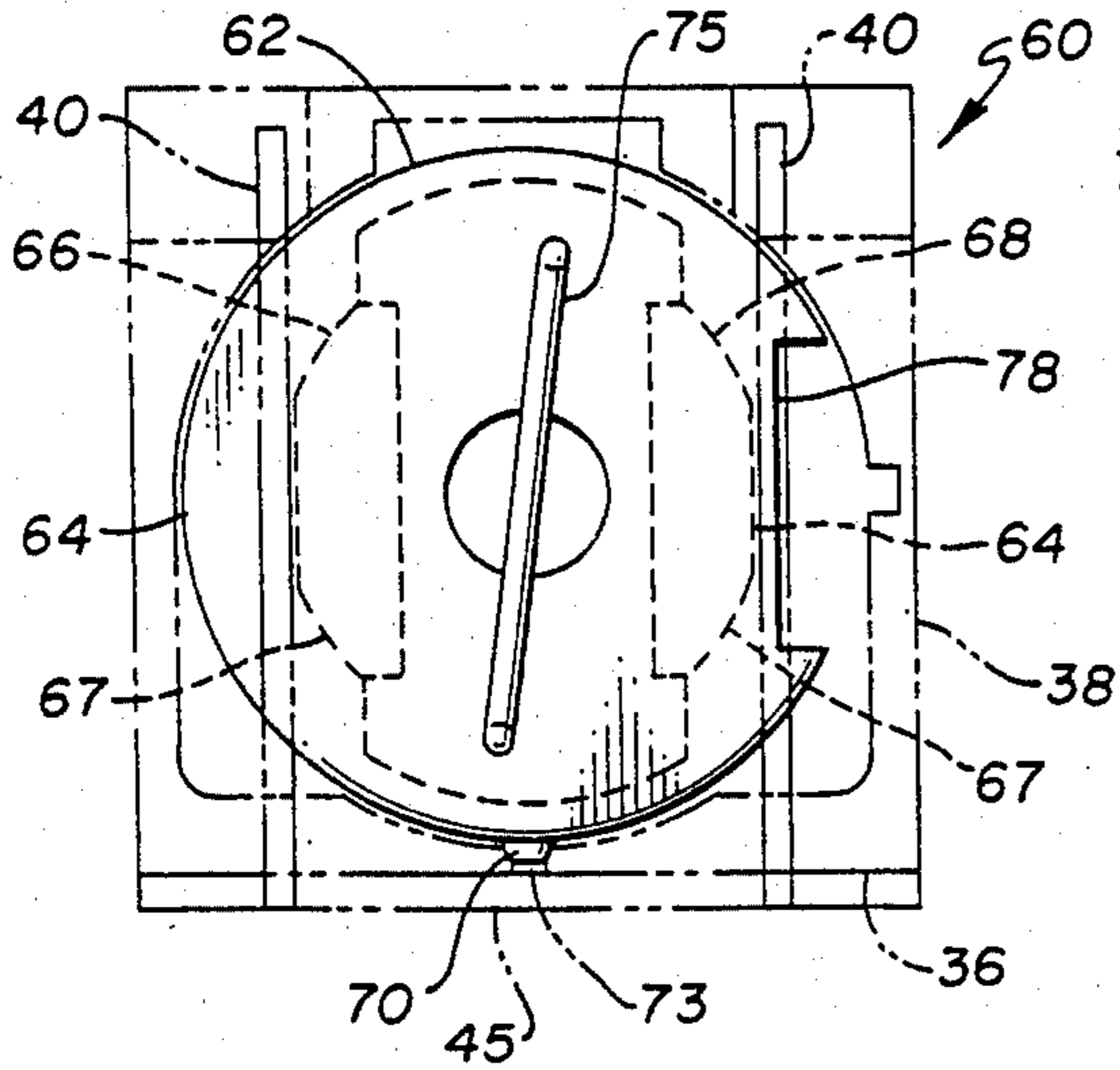


Fig. 5

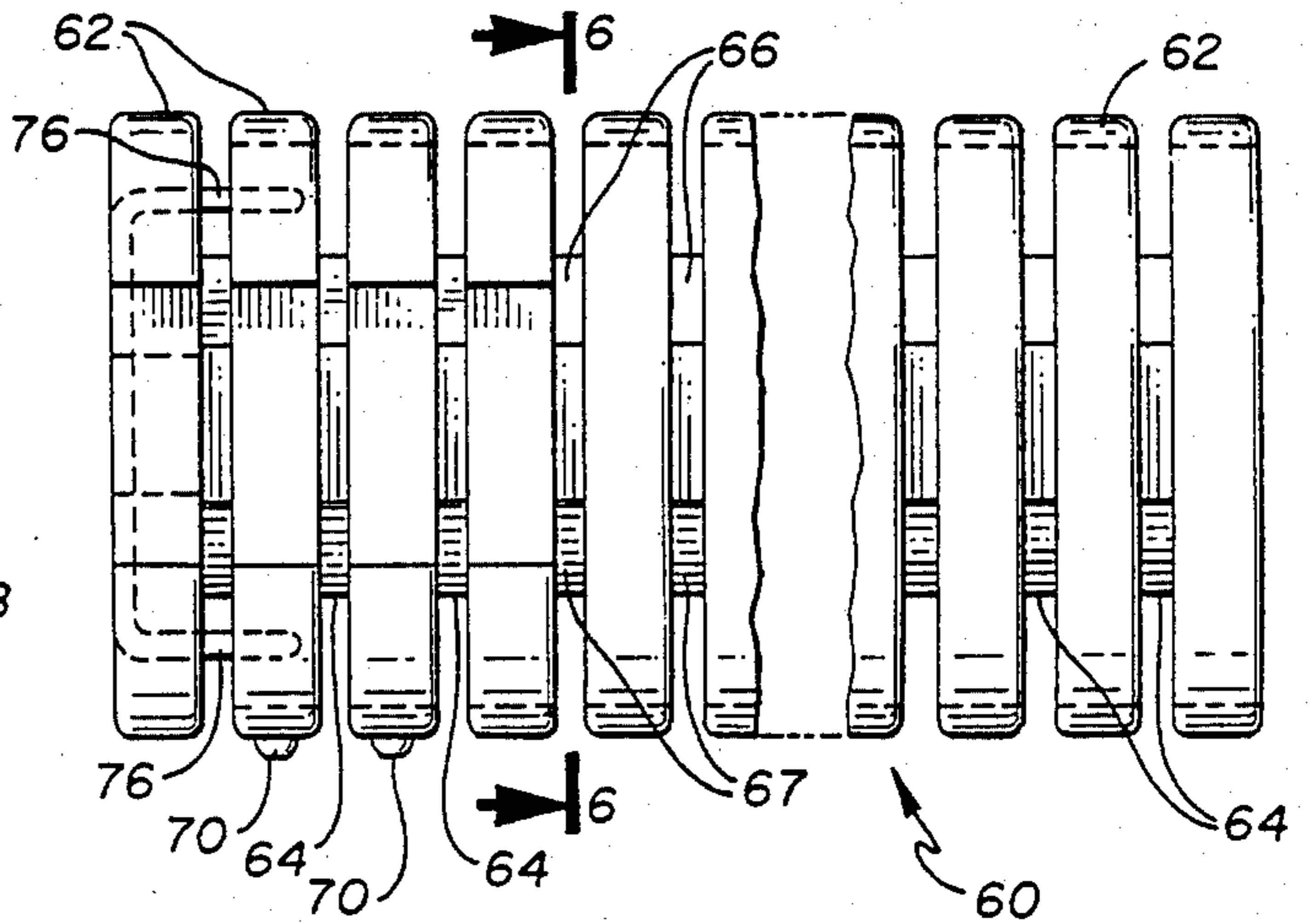


Fig. 6

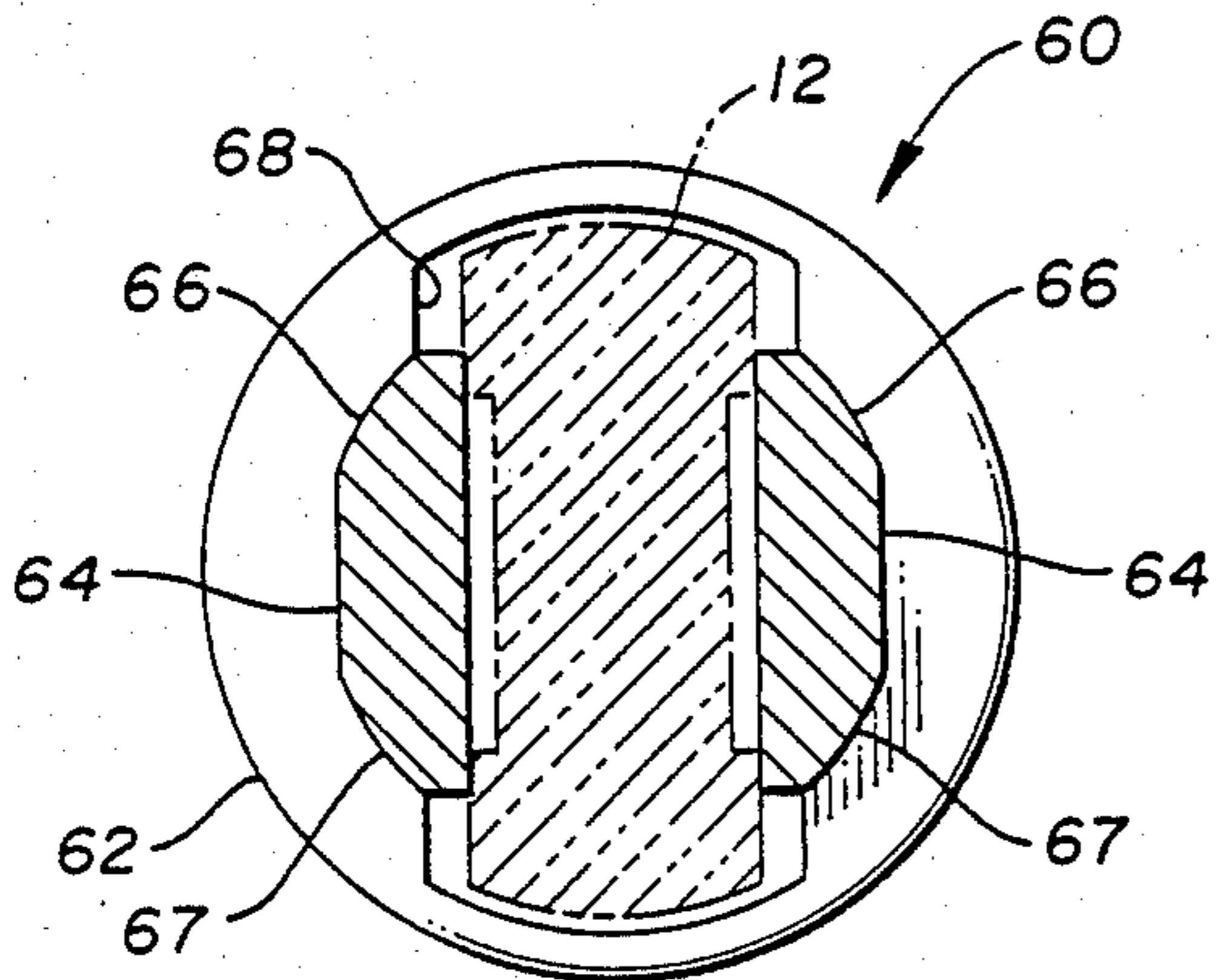


Fig. 7

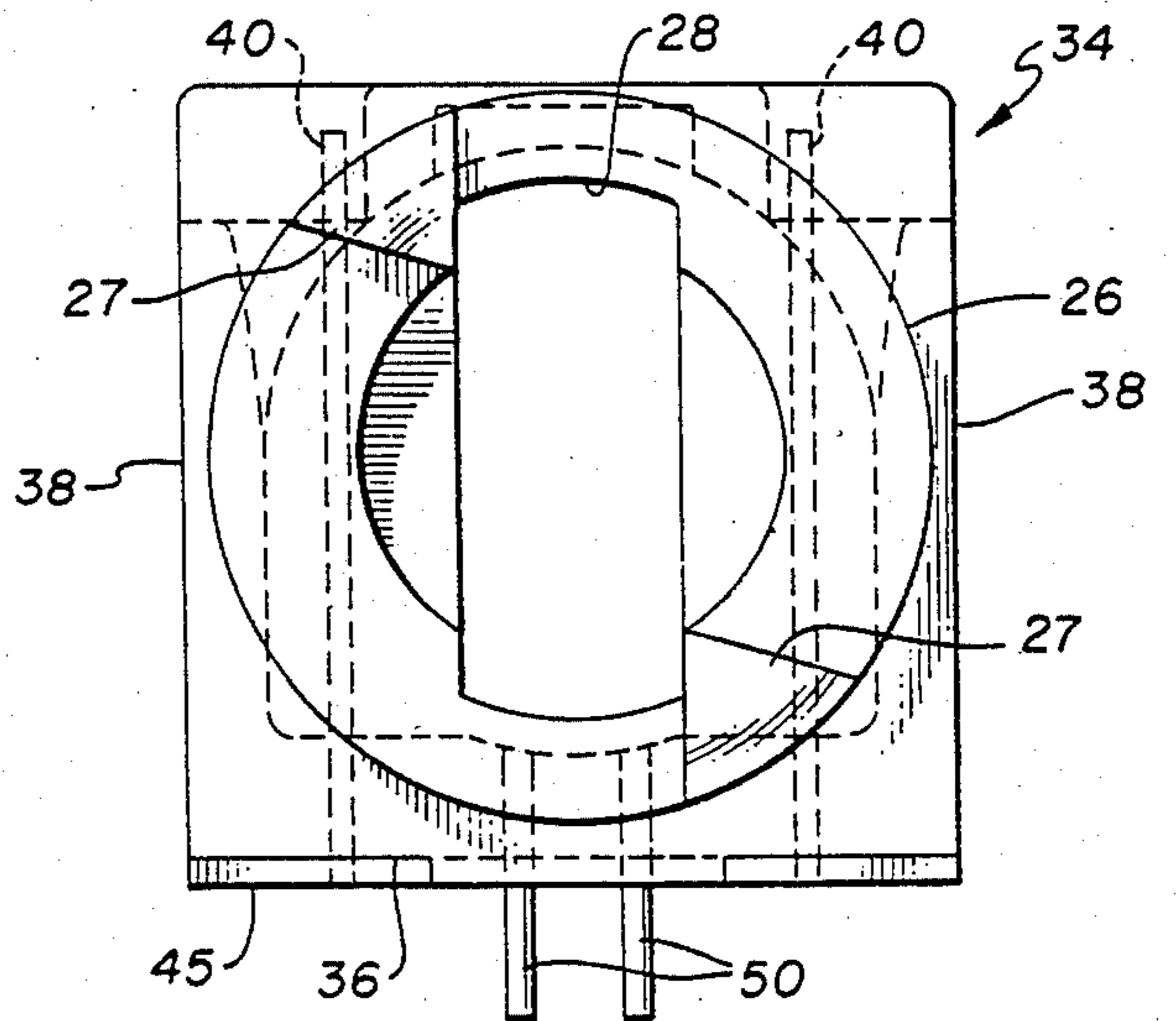


Fig. 8

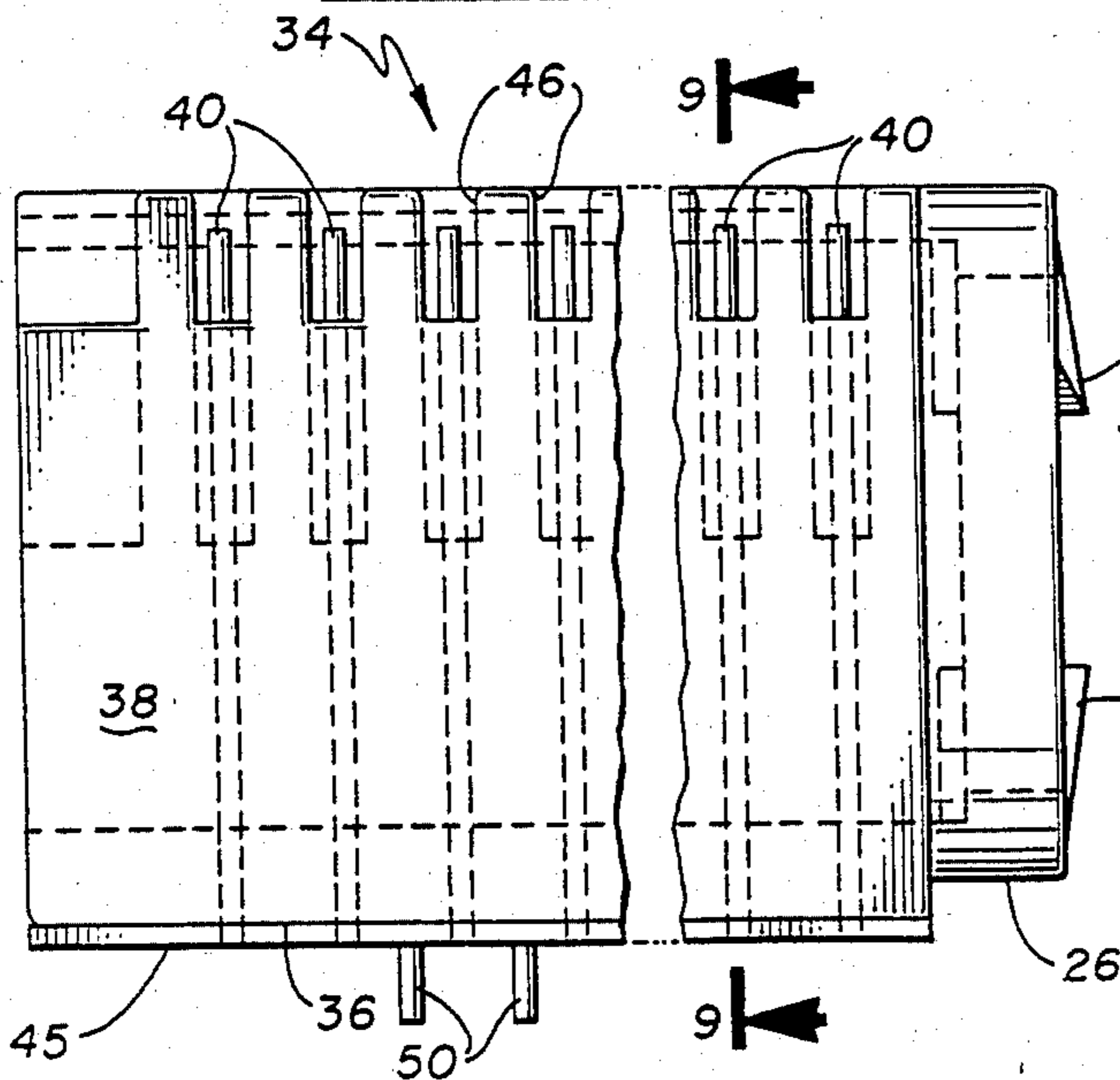


Fig. 9

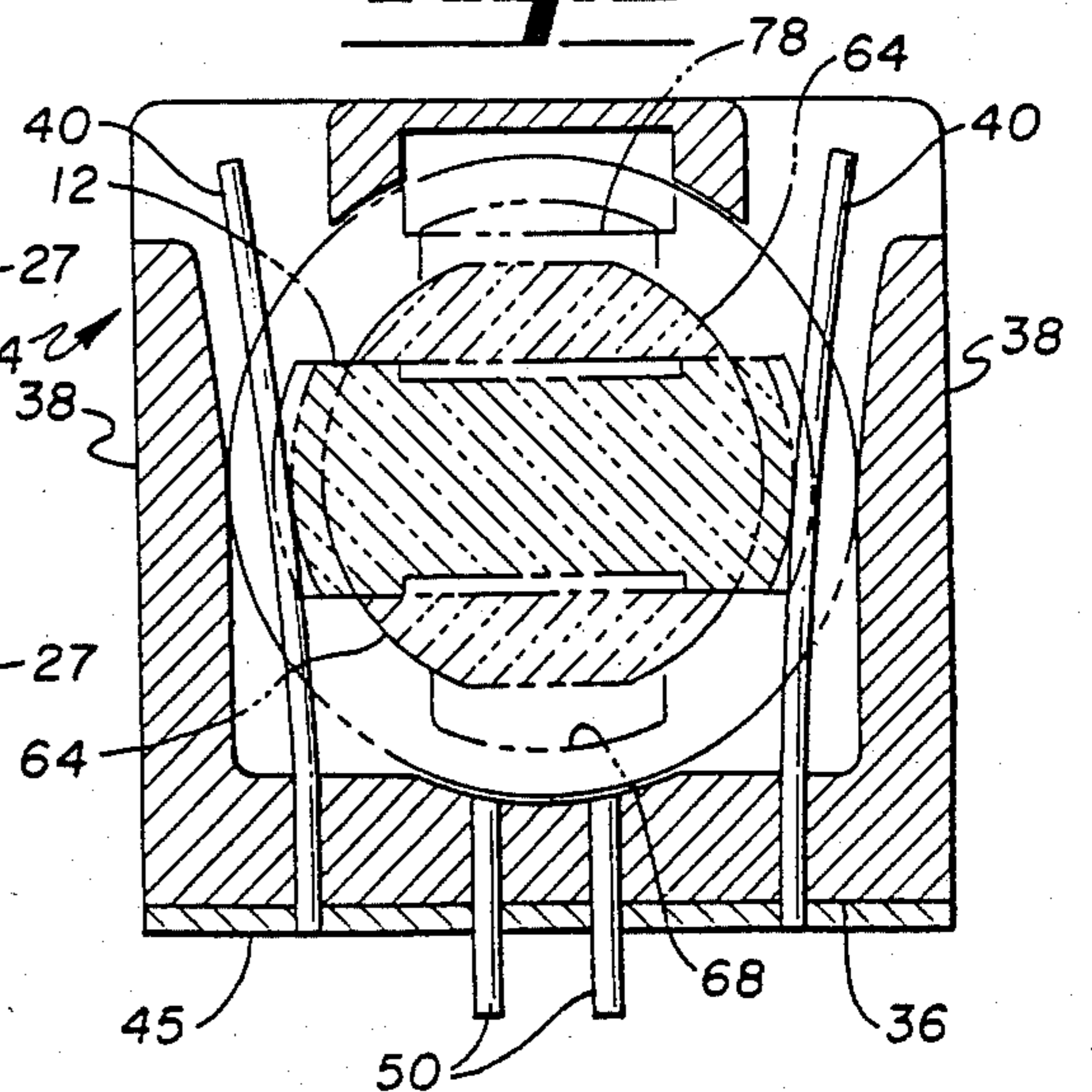


Fig. 11

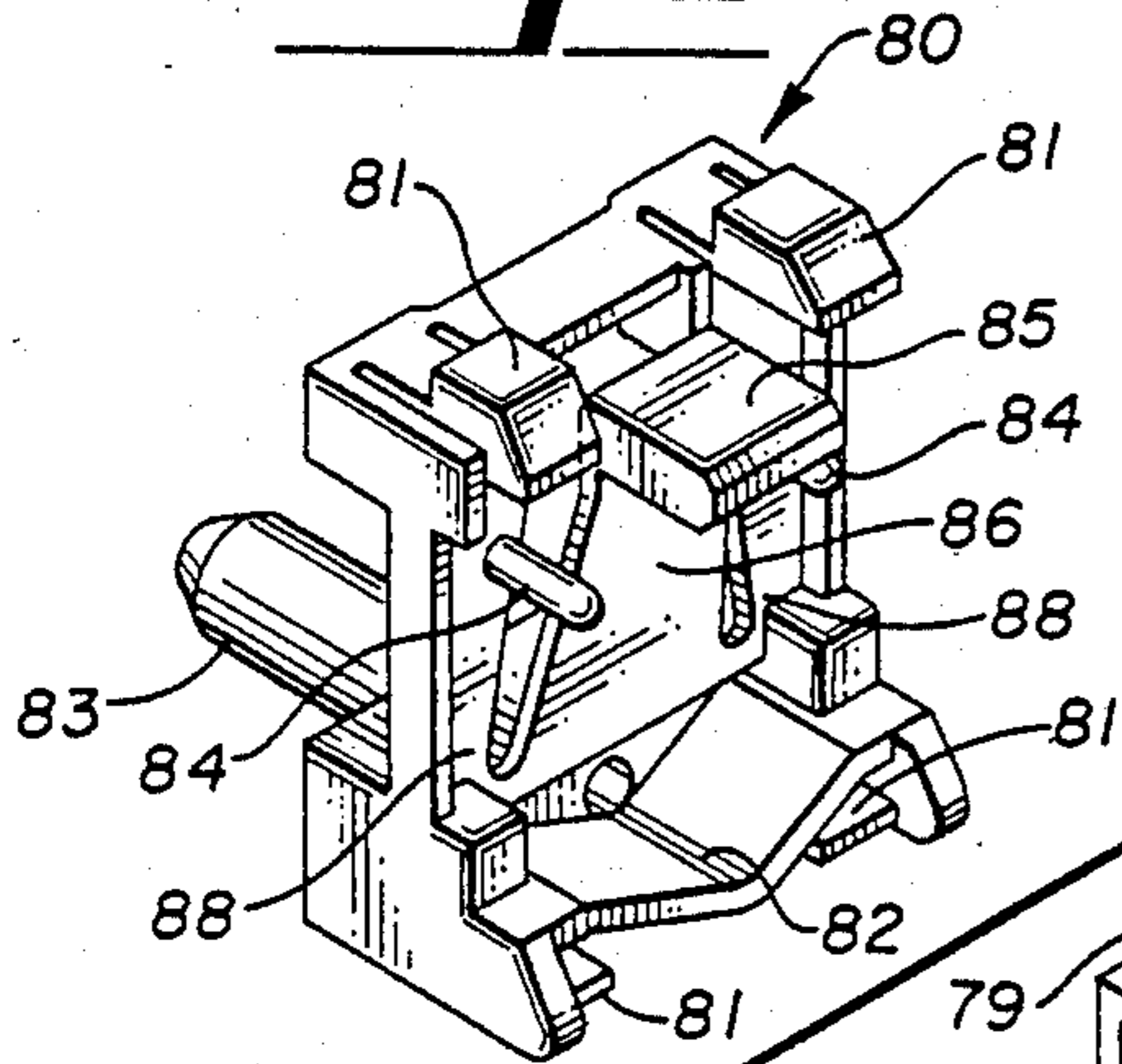


Fig. 10

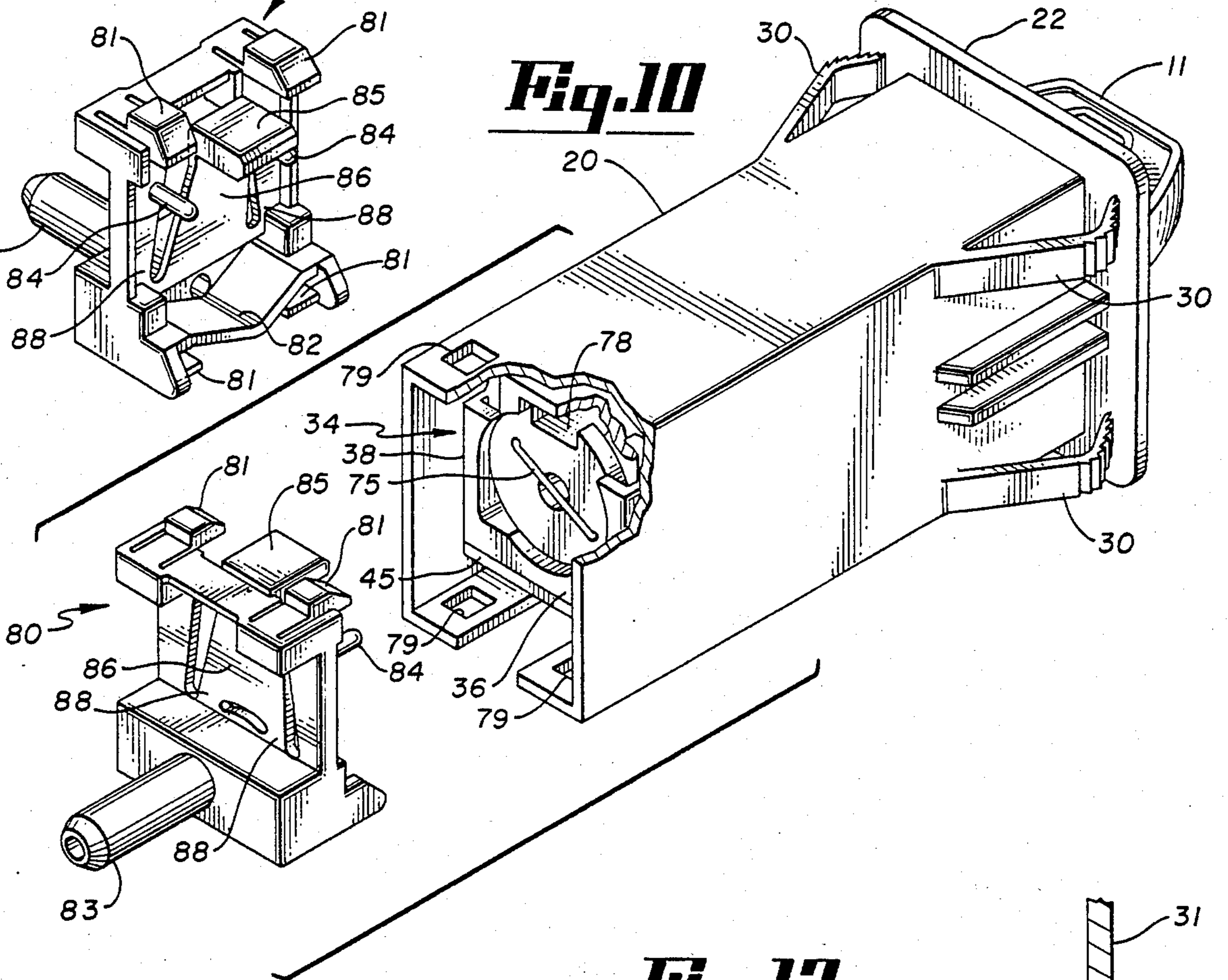


Fig. 12

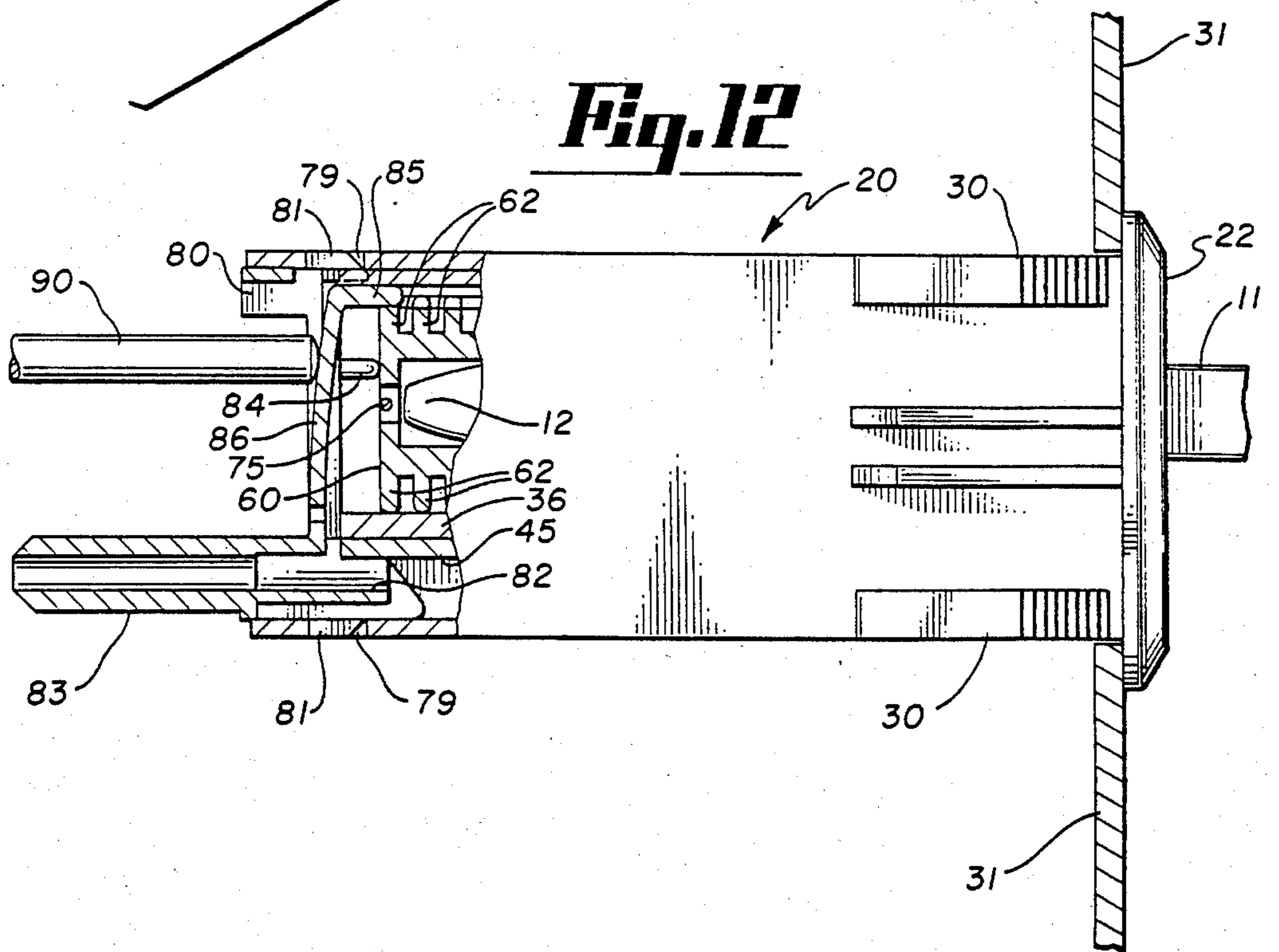


Fig. 13

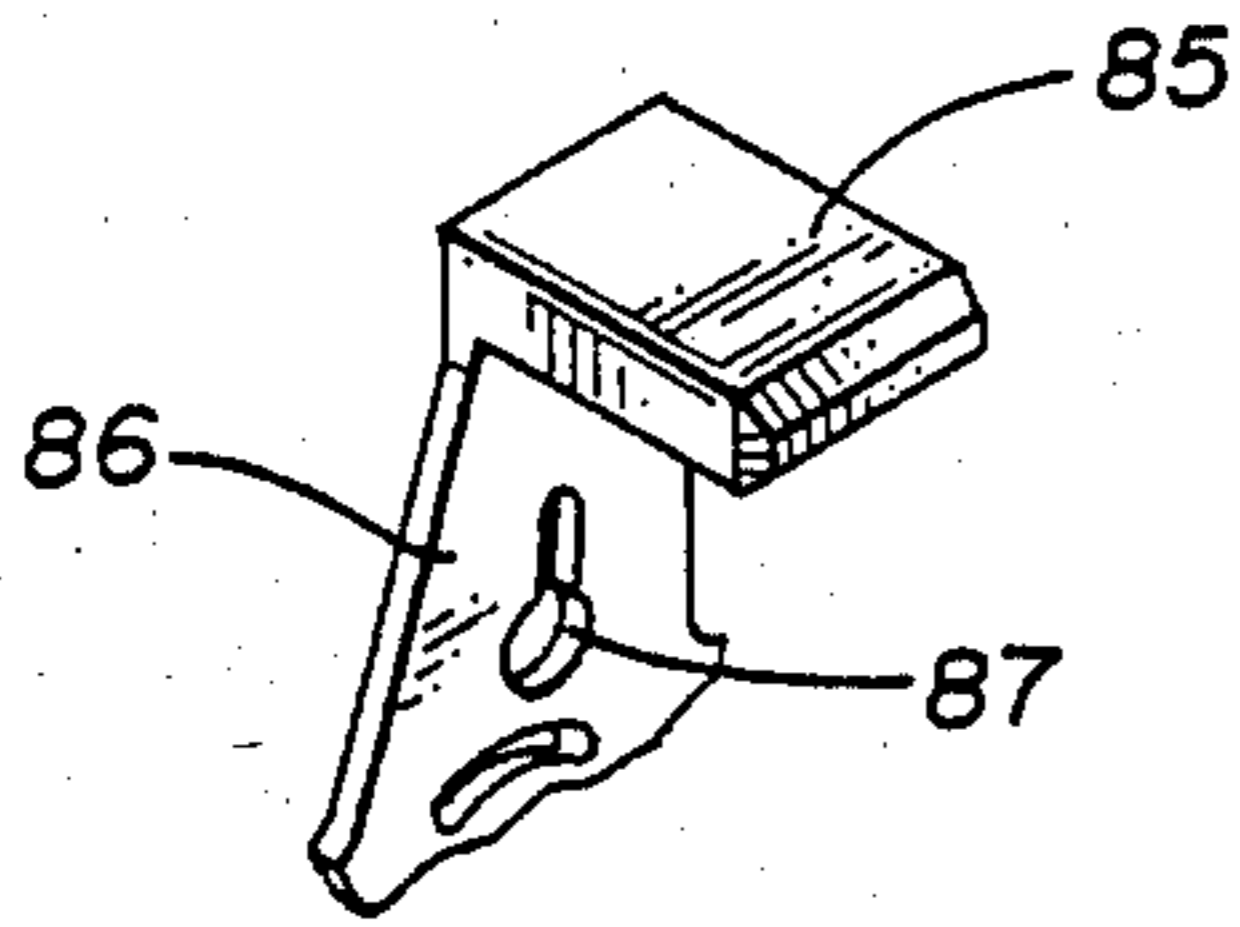


Fig. 14

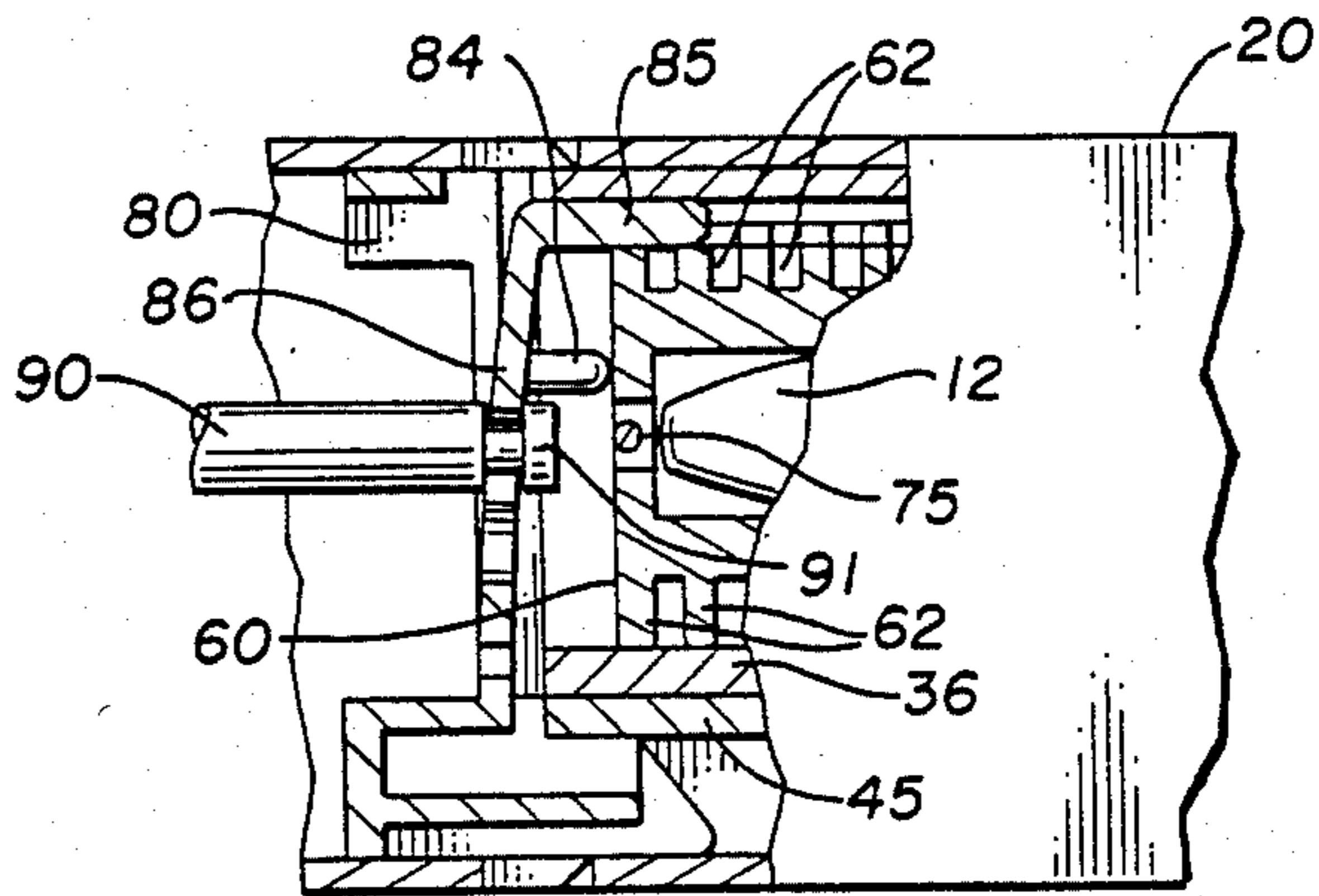
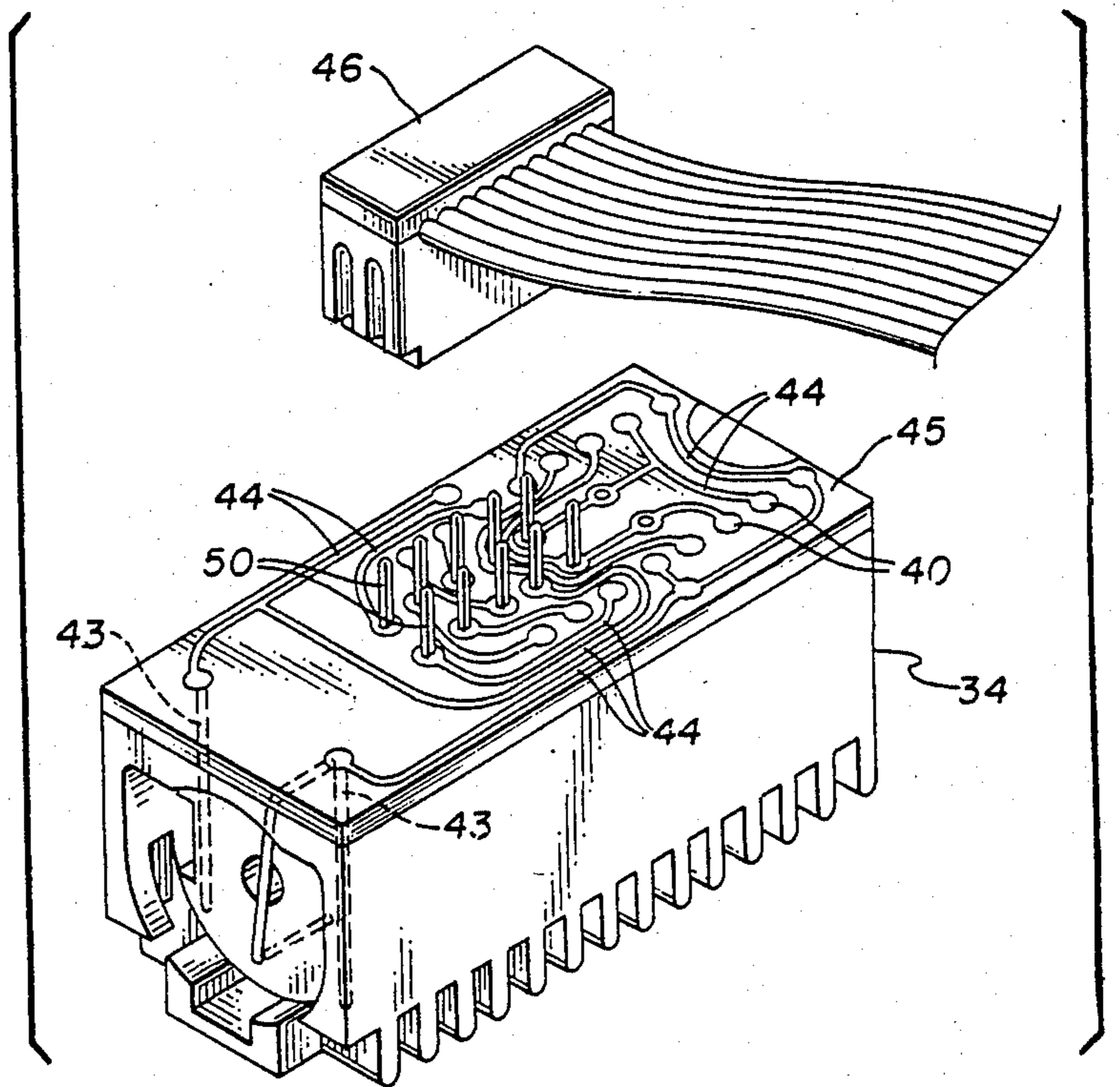


Fig. 15



RECEPTACLE DESIGN FOR USE WITH ELECTRONIC KEY-LIKE DEVICE

This is a division of application Ser. No. 471,424, filed 5
Mar. 2, 1983, now U.S. Pat. No. 4,620,088.

DESCRIPTION

1. Background of the Invention

This invention relates to improvements in the func- 10
tional design of electrical receptacles for use in combi-
nation with electrical key-like devices. The invention is
an improvement over the inventions of U.S. Pat. No.
4,297,569, issued Oct. 27, 1981, entitled "Microelec-
tronic Memory Key With Receptacle and Systems 15
Therefor", U.S. Pat. No. 4,326,125, issued Apr. 20,
1982, entitled "Improvement Microelectronic Memory
Key With Receptacle and Systems Therefor", U.S. Pat.
No. 4,379,966, issued Apr. 12, 1983, entitled "Recepta-
cle for Electronic Information Key", U.S. Pat. No. 20
4,436,993, issued Mar. 13, 1984, entitled "Electronic
Key", and pending application Ser. No. 343,112, filed
Jan. 27, 1982, entitled "Lock Mechanism for Electronic
Information Key" (now abandoned).

Electrical key-like devices have been proposed in 25
which a master circuit or electrical operating system of
some kind, such as a computer system, is activated by
use of a portable device which is combined with the
electrical system, as by insertion into a slot or the like,
to make electrical contact or connection with the sys- 30
tem. This invention is concerned broadly with such
portable devices and with such systems. However, it is
specifically concerned with a receptacle for receiving
the electrical key-like devices and providing electrical
connection between the device and a computer or other 35
master circuit operating system. As already noted, such
key-like devices and receptacles therefor have been
described in several patents and patent applications.
The key-like devices of these aforementioned patents
and patent applications retain relatively large amounts 40
of data bits (information) in a portable medium of small
size. Very fast data access and data transfer rates are
provided by electrical connection of such devices to a
master electrical circuit means including a program
memory and a processor by insertion of the key-like 45
device into specially designed electrical receptacles. It
is desirable that the receptacles have a design which
provides good electrical contact with the computer,
even after prolonged usage. It is also desirable that the
electrical contacts in the receptacle be protected from 50
casual damage when the receptacle is not in use. It is
also desirable that the receptacle act as a buffer against
static discharge into the master operating system. It is
an aim of this invention to fulfill these and other objec-
tives which will become apparent hereinbelow. It is also 55
an objective of this invention to provide an improved
receptacle design in which a printed circuit board elec-
trically connected to the contacts inside the receptacle
may be readily adapted to facilitate connection of the
receptacle to standardized electrical connectors of vari- 60
ous sizes and shapes, thereby facilitating connection of
the receptacle into various operating circuits.

BRIEF SUMMARY OF THE INVENTION

The aforementioned patents and patent applications 65
describe a key-like devices which, in the preferred form
of a microelectronic data key, provide relatively large
amounts of data bit storage with very fast access time

while being packaged in a durable medium. The micro-
electronic data keys described therein are not only con-
cerned with the storage of data (information) and its
introduction into a computer or other electrical circuit,
but also with the portability of microelectronic circuit
chips or dies, whether the purpose of the electrical
circuit system into which the key is introduced is the
storage of information or any other purpose, such as a
control function.

The various circuit elements which may be embed- 10
ded in the key are packaged in a sturdy configuration
which may be inserted into a receptacle connected to an
access device or the like for a variety of purposes. Any
circuit means that can be so packaged and which can
augment any other existing circuit contained in the 15
master operating system is usable in such keys. The
key-like devices are specifically designed for insertion
into an electrical receptacle and rotation therein to
establish contact through the receptacle to the master
electrical system.

The present invention relates to improvements in the
design of such receptacles, the primary aim being to
improve the manufacturability of the receptacles, im-
prove the cooperation between the key-like devices and
the receptacle, decrease the likelihood of physical dam-
age to the receptacle contacts and diminish or eliminate
problems created by static electricity. Additional fea-
tures, such as the ready adaptation of the receptacle for
connection to standardized connectors, drainage fea-
tures and locking the receptacle against use by an inte-
gral latching arrangement, are included, as well as vari-
ous other features.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial view showing the receptacle of
the invention mounted in its case container with an
electronic key being inserted into the keyway opening.

FIG. 2 is an exploded pictorial view of the receptacle,
the printed circuit board and contact pins and the head
protect sleeve or receptacle contact pin guard means.

FIG. 3 is a partial top elevational view showing the
receptacle case container in a mounted condition.

FIG. 4 is a distal end view of the head protect sleeve.

FIG. 5 is a slide elevational view of the head protect
sleeve. 45

FIG. 6 is a sectional view of the head project sleeve
taken along line 6—6 of FIG. 5.

FIG. 7 is a proximal end elevational view of the re-
ceptacle.

FIG. 8 is a side elevational view of the receptacle.

FIG. 9 is a sectional view of the receptacle taken
along lines 9—9 of FIG. 8.

FIGS. 10, 13, 14 and 15 are exploded pictorial views
of the receptacle in its container case with parts broken
away showing the distal end closure member. 55

FIG. 11 is a pictorial detail showing interior portions
of the closure member.

FIG. 12 is a right side elevational view of the recepta-
cle in its container case as mounted with parts broken
away to show the latching mechanism on the cover
member in a locked position. 60

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, there is shown a portable random access
data device or key-like device generally designed 10,
and referred to hereinafter simply as the "key". Key 10
comprises non-conductive head and insert body por-

tions 11 and 12, respectively. The insert body portion 12 contains a circuit element, such as an integrated circuit or microelectronic chip embedded therein (not shown). Leads 16 of the circuit element extend therefrom through the body portion of the key to the upper and lower surfaces thereof where they lie exposed within spaced contact grooves 18 to form electrical contact areas on the key.

As also shown in FIG. 1, a receptacle container case, generally designated 20, carries at its front or proximate end a bezel 22 having a central opening 24 through which a receptacle flange 26 extends outwardly to form a keyway opening 28. Opening 28 is preferably a compound shape comprising a generally rectangular slot which permits insertion of the key insert portion 12 into the receptacle and a generally circular central expansion area, the diameter of which corresponds generally to the thickness of the key between grooves 29 located adjacent head portion 11 of the key. The shape of keyway opening 28 cooperates with grooves 29 so that the key may not be rotated until it is fully inserted into the receptacle. Additionally, once rotation has begun, the key may not be removed until it is returned to the insertion position.

Container case 20 includes flexible locking mount tabs 30 by means of which container 20 may be mounted in the wall 31 of a supporting structure (shown in FIG. 3), such as the face of some kind of peripheral equipment or the like. With lock tabs of the type shown at 30, the case container 20 may be merely inserted into an opening in wall support 31 until bezel 22 contacts the wall. Lock tabs 30 then lock the case container into position, as shown in FIG. 3. Bezel 22 may also include signal means at 32 and 33, such as appropriately colored LED (light emitting diodes), red and green preferred, to signal the readiness of the receptacle to receive a key and to signal operation of the system when the key has been inserted into the receptacle and turned to a contact position therein, respectively.

Referring now to FIG. 2, the electrical receptacle can be seen to be a multi-part assembly which includes an elongate housing, generally designated 34. As shown in FIG. 2, housing 34 is viewed from its distal or rear end 35 and in a position which is inverted from its normal position and use, i.e. with the base portion 36 oriented upwardly. Opposing sides 38 extend from base portion 36 to form a slotted enclosure portion which defines an elongate interior housing chamber.

The receptacle also includes a plurality of inner finger-like spring contact pins 40 which are spaced along the sides of the housing chamber, as best seen in FIG. 8. Contact pins 40 are inserted into receptacle housing 34 through rows 41 of openings (best seen in FIG. 2) and through corresponding rows of openings 42 in printed circuit board 45, which is attached to base 36 as by a suitable adhesive many of which are readily available. The pins are best inserted through printed circuit board 35 and base portion 36 of receptacle housing 34 by a staking operation using a staking machine, an operation and equipment which are well known. There is thus provided a spaced series of contact pins 40 inside receptacle 34 which are fixedly supported in base portion 36 and cantilever or extend through corresponding slots 46 in enclosure portion 38. Preferably these pins are of stainless steel or the Paliney® type 6-9 or type M alloys, available from the Ney Company. Preferably, the inner walls of the interior housing chamber will include rounded or curving surfaces 48, as best seen in FIG. 2.

Contact pins 40 may be soldered into the openings 42 on printed circuit board 45. Preferably, these openings will comprise standard plated barrels contacted by printed circuit pathways extending over the surface of the board (not shown in FIG. 2), as is typical in the printed circuit board art.

Connector pins 50 are staked into printed circuit board 45 and may extend into the base 36 of receptacle housing 34, as shown in FIGS. 7, 8 and 9. Preferably, contact pins 50 will be received and soldered in printed circuit barrels on printed circuit board 45 for appropriate connection to the conductive pathways on the printed circuit board. Conductive pins 50 will also extend outwardly from the board a sufficient distance and in a predetermined spaced arrangement so as to provide a series of pins adapted to be contacted by a standard sized electrical connector which serves as the means for connecting the receptacle into the aforementioned master electrical circuit or operating system by means of a conductive ribbon type lead connected to a female ribbon type connector into which arranged contact pins 50 are inserted.

As can be seen from FIG. 2, contact pins 50 may be arranged in two inner rows 51 on base support 36 and two corresponding inner rows 52 on printed circuit board 45. Alternatively, contact pins 54 (shown in FIG. 2) may be used if desired and located in outer rows 55 and 56 on base portion 36 and printed circuit board 45, respectively, to allow connection to a different sized electrical connector. It can be seen, by varying the arrangement of the contact pins, various standard sized electrical connectors can be accommodated to receive the contact pins of the receptacle. Reference may be made to FIG. 15 for an example of a specific printed circuit board arrangement.

As can be seen from the above, with spaced contact pins 40 in place and external connection pins 50 in place or the optional external connection contact pins 54 in place, key 10 may be inserted into the receptacle housing through keyway 28 and turned or rotated so as to cause the electrical contacts 16 thereof to mate with the oppositely disposed contact pins 40 in receptacle housing 34. The key has an insert position in which its contacts are angularly displaced from the receptacle contacts and a locked or contact position in contact with the receptacle contacts. Receptacle housing 34 includes, as previously noted, flange 26, which preferably carries a pair of spaced key stops 27 radially arranged about keyway opening 28 so as to allow the upright insertion of key 10 into the receptacle and rotation thereof 90° to a position in which contacts 16 on key 10 mate with contact pins 40 as best seen in FIG. 9.

However, due to the fact that contact pins 40 are exposed to potential damage by the insertion of miscellaneous objects through keyway opening 28 into the interior chamber of the receptacle, it is preferred that the receptacle include a contact pin protect sleeve or guard means, generally designated 60 in FIG. 2, further details of which are best seen in FIGS. 4, 5 and 6.

The contact pin protect sleeve or guard means 60 is a generally tubular structure of cylindrical shape preferably, although various cross-sectional shapes may be utilized so long as the structure is rotatable within the appropriate shaped chamber of receptacle housing 34. As can be seen from FIG. 2, the interior surfaces of the housing chamber are suitably curved to facilitate rotation of cylindrical guard means 60 therein. FIGS. 4, 5 and 6 should also be referred to in addition to FIG. 2 for

details concerning the structure of guard means 60. From these Figures, it can be seen that the guard is formed of a plurality of discoid elements 62 concentrically spaced along a common axis and interconnected by two oppositely disposed rows of paired rib elements 64. Preferably, rib elements 64 will have inwardly tapered tops and bottoms 66 and 67. The discoid elements 62 contain aligned openings 68 which, along with the rib-like elements 64, define a keyway into which a key-like device, such as key 10, may be inserted when guard means 60 is carried within the chamber of receptacle housing 34. As can be seen from FIG. 2, guard means 60 may be inserted into the interior housing chamber by means of an opening at the distal end of housing 34. The keyway defined by discoid elements 62 and rib elements 64 has an open top and bottom between the spaced discoid elements, the sides of which are closed by rib elements 64.

As shown in FIGS. 2 and 4, one or more detent elements 70 may be carried on the periphery of discoid elements 62 and an appropriate seat 73 may be provided in housing receptacle 34 to facilitate assembly of the receptacle and to afford a positive snap-action to rotation of guard means 60 when rotated in receptacle housing 34. Preferably, detents 70 and seats 73 will be so arranged as to position the keyway of guard means 60 in a normally open or upright position, hereinafter termed the "guard" position, in which the rib elements 64 are positioned along the sides of receptacle housing 34 such that contact pins 40 lie alongside rib elements 64 which separate contact pins 40 from keyway 68, thus preventing their exposure when a key is not inserted into the receptacle. Upon insertion of a key and rotation thereof, guard means 60 rotates with the key to a position, as shown in FIG. 9, whereby contacts 16 on the key are able to contact the contact pins 40 through the open top and bottom of the keyway defined by the guard means.

The receptacle will also preferably include a switch element referred to herein as a last-on-first-off (LOFO) switch, the purpose of which is to render certain that all contact pins 40 are completely contacted by all key contacts 16 before the LOFO switch is closed, allowing electrical connection between the key contacts, the receptacle contacts and the operating circuitry. Preferably, the LOFO switch will comprise a pair of contact pins identical to pins 40 disposed at the distal end of receptacle housing 34 and a shunt in the form of a U-shaped or staple-shaped wire 75 inserted into the last pair of discoid elements 62, as shown in FIGS. 2 and 4, at the distal end of guard means 60. As can be seen in FIG. 4, the staple 75 is arranged a few degrees from vertical so as to lag behind the rotational movement of the key contacts 16 when a key is rotated in keyway 68 to contact contact pins 40 in the receptacle. Consequently, contact by legs 76 to the oppositely disposed contact pins in the receptacle will lag contact between the key contacts 16 and contact pins 40, making certain that all key/receptacle contacts are positively made before legs 76 contact the corresponding receptacle contact pins to provide electrical connection between all contacts and the operating circuit.

The last several discoid elements 62 of guard means 60 are also notched, as shown at 78 in FIGS. 2 and 4, to provide for locking of guard means 60 against rotation, if desired, by means of a suitable latching mechanism, one form of which will be described hereinbelow.

In assembling the receptacle, guard means 60 is inserted into the chamber of housing 34. Printed circuit

board 45 is positioned appropriately on base 36 and contact pins 40 are staked through printed circuit board 45 and base 35 of receptacle housing 34 to extend between discoid elements 62 alongside rib elements 64 and into slots 46. Consequently, guard means 60 is held inside receptacle 34 primarily by means of staked contact pins 40. Additional contact pins 50 and 54 are also staked into printed circuit board 45 at this time and all contact pins are soldered or otherwise connected permanently to the barrels of the printed circuit board through which the pins have been staked. The guard means is positioned such that the keyway is in an upright position aligned with the keyway opening 28 and flange 26 on receptacle housing 34 with detents 70 in seats 45.

The partially assembled receptacle is then inserted into case container 20 through the opened distal end thereof, as shown in FIG. 10, with flange 26 emerging through opening 24 and bezel 22.

A closure member, generally indicated at 80 in FIGS. 10 and 11, having locking tabs 81 which fit into openings 79 on case container 20 is then locked into position to close the end of the container. Cover member 80 will preferably also include a drain pan or liquid collection member 82 and an outlet conduit 83 leading from the interior drain pan to the exterior of container 20. Consequently, any liquid, such as rain water or the like which might gain access to the receptacle or container, may be drained therefrom.

Cover member 80 also includes two support arms 84 which rest against end 35 of the receptacle housing 34 to provide internal support for the cover.

The mechanism of operation of the receptacle is as follows. When key 10 is fully inserted, it may be rotated to bring key contacts 16 into engagement with receptacle contact pins 40. As the key is rotated from the insertion position to the contacting or "locked" position, pressure on contact pins 40 displaces them outwardly as shown best in FIG. 9.

Cover member 80 also preferably includes a latch member 85 (best seen in FIG. 13) carried by a flap member 86 which is hinged at its base to the cover member, as shown at 88. Preferably, cover member 80, as well as all other component parts of the receptacle, such as guard means 60 and receptacle housing 34, will be made of non-conductive molded plastic, such as DELRIN® acetol resin, available from E. I. DuPont de Nemours Co. of Wilmington, Del. 19898, which functions well for the component parts mentioned above, as well as possesses requisite flexibility for providing hinge portions 88 which retain flexibility over a long period of life. Other plastics may be used as well. The arrangement described for latch member 85, which is normally substantially upright in the plane of the cover, allows its movement inwardly of the unit to engage notches 78 and lock guard means against rotation when desired. This may be accomplished by means of a rod 90 (shown in FIG. 12) which may be remotely operated by any suitable arrangement, such as an electrically actuated solenoid. The end of rod 90 may be modified as shown at 91 in FIG. 14 to be received in slot 87 (best seen in FIG. 13) of member 86. With such a latching mechanism in place the unit may be locked as desired. For example, the master operating circuit may be designed so as to recognize unauthorized keys, such as stolen keys or the like, when inserted into the receptacle and rotated to the contact position. Such an occurrence may

be arranged to cause locking of the latch mechanism so as to prevent removal of the unauthorized key.

A specific printed circuit board arrangement is shown in FIG. 15 showing various pathways indicated at 44 which connect contact pins 40 seated in the circuit board 45 to various connector pins 50 and to LOFO contact pins 43. Ribbon-type connector 46 of standardized size may be used for electrically contacting pins 50 which are suitably arranged to mate therewith. As already pointed out, any number of contact pins arrangements may be made for the receptacle and printed circuit board.

To remove potentially interfering static electricity from the key or the bodies of users, the receptacle may be provided with optional conductive areas about the bezel which may be connected to ground. For example, entire bezel 22 or flange 26 may be made of plastic which has been filled with conductive materials, such as filled carbon black or carbon fibers. Such an arrangement provides a preferred path for the discharge of static electricity originating on the body of the user or on the key and wipes the static charge off of the key before it enters the receptacle where the static electricity might possibly discharge through the contacts and into the master control circuit.

Having described the invention, the inclusive rights thereto are set forth in the following claims.

What is claimed is:

- 1. An electrical receptacle which is electrically activated by insertion and rotation of an electronic key-like device having electrical contact surface areas thereon for mating with corresponding contacts in the receptacle, the receptacle comprising:
 - an elongate housing defining an elongate interior housing chamber having an open end into which an electronic key-like device may be inserted and rotated in the chamber;
 - a set of spaced electrical contacts, arranged in the chamber so that, as an inserted key-like device is rotated in the receptacle, each contact thereon is

urged into engagement with a respective receptacle contact, and

receptacle contact guard means defining a keyway, the guard means being rotatably carried within the receptacle housing chamber such that the key-like device, when inserted into the contact guard means, may be rotated to cause accompanying rotation of the guard in the housing from a "guard" position to an "access" position, the guard serving as a barrier for preventing access to the receptacle contacts via the keyway when in the "guard" position and allowing contact of the key-like device contacts to the receptacle contacts when in the "access" position.

- 2. The receptacle of claim 1 in which the guard means comprises a generally tubular-like structure formed by:
 - a plurality of discoid elements concentrically spaced along a common axis;
 - two oppositely disposed rows of rib elements interposed between and interconnecting the discoid elements so as to provide a guard means having closed sides and an open top and bottom, the rib elements being inset relative to the edges of the discoid elements; and
 - the receptacle contacts are respectively positioned between the discoid elements adjacent the rib elements when the guard means is in the "guard" position and adjacent the open top and bottom when in the "access" position.
- 3. In combination with an electrical receptacle having a keyway and a set of receptacle contacts, guard means for preventing access through the keyway to the receptacle contacts by objects other than a key designed for operation with the receptacle, the guard means comprising: an elongated member lying within the the keyway adapted and arranged to receive the key and being rotatable within the keyway by means of the key from a guard position, in which the contacts are protected by the member, to an exposed position in which contact between the key and the receptacle contacts is permitted.

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